S No. 0004033 A–GSE–P–HMD

HYDROGEOLOGY

Time Allowed : Three Hours	Maximum Marks : 200

INSTRUCTIONS

Please read each of the following instructions carefully before attempting questions.

There are NINE questions divided under FIVE Sections.

Candidate has to attempt FIVE questions in all.

The ONLY question in Section—A is compulsory.

Out of the remaining EIGHT questions, the candidate has to attempt FOUR, choosing ONE from each of the other Sections B, C, D and E.

The number of marks carried by a question/part is indicated against it.

Symbols, abbreviations and notations have their usual standard meanings.

All parts and sub-parts of a question are to be attempted together in the answer book.

Attempts of questions shall be counted in sequential order. Unless struck off, attempt of a question shall be counted even if attempted partly.

Answers must be written in ENGLISH only.

Neat sketches are to be drawn to illustrate answers, wherever required.

Wherever required, graphs/tables are to be drawn on the answer book itself.

Any page or portion of the page left blank in the answer book must be clearly struck off.

Section—A

(Compulsory Section)

1. Write short notes on the following in not more than *5* sentences each :

(a) Water balance concept 5

(b) Specific yield 5

(c) Drawdown in hydrogeology 5

(d) Steady-state groundwater flow condition 5

(e) Electromagnetic radiation 5

(f) SAR (Sodium Absorption Ratio) 5

(g) Radon gas in groundwater 5

(h) High-nitrate groundwater 5

Section—B

Attempt *any* **one** question

2. (a) With a neat sketch, describe the vertical distribution of groundwater. Write a note on seasonal variation of ground-water level fluctuation. 15

(b) With a neat sketch, differentiate between confined aquifer and unconfined aquifer. Write a note on perched aquifer and its significance in water supply schemes. 15

(c) Discuss the hydrological properties of rocks. 10

3. (a) What are springs? How are springs useful as a source of water supply? 15

(b) Explain the different types of springs with special reference to hot springs. 15

(c) Write a note on the importance of hydrographs. 10

Section—C

Attempt *any* **one** question

4. (a) Explain Darcy's law. What is meant by 'hydraulic conductivity' according to Darcy's law? 15

(b) Explain the 'cone of depression' with suitable illustrations. 15

(c) The thickness of an aquifer is found to be 20 m. Its hydraulic conductivity is 20 cm/day. Calculate the transmissivity of the aquifer. 10

5. *(a)* Discuss critically the role of Water Table Contour Maps and Flow Net Analysis in groundwater studies. 15

(b) Explain with neat sketches how permeability is measured in the laboratory. 15

(c) A confined aquifer is 35 m thick and 5 km wide. Two observation wells are located 1·5 km apart in the direction of groundwater flow. The head in well 1 is 100 m and in well 2 is 85 m. The hydraulic conductivity is 2·5 m/day. What is the daily flow of water through the aquifer? 10

Section—D

Attempt *any* **one** question

6. *(a)* Explain the principle involved in electrical resistivity method of groundwater exploration. 15

(b) Discuss the field procedure in conducting electrical resistivity survey. 15

(c) Explain how electrical resistivity data is interpreted using curve matching technique in 2-layered cases. 10

7. *(a)* Explain how hydrogeomorphic mapping is done using different satellite images and how they are useful in preparing groundwater potential zone maps. 15

(b) Discuss how Geographic Information System (GIS) is used in integrating thematic maps. 15

(c) Explain the usefulness of resistivity logging in delineation of aquifers and quality of water. 10

Section—E

Attempt *any* **one** question

8. *(a)* What are the causes of saline water intrusion into coastal aquifers? Explain the Ghyben-Herzberg relationship between saline water and freshwater. 15

(b) What are the possible geogenic sources of fluoride in groundwater? Comment briefly on the distribution of fluoride-enriched groundwater in India. 15

(c) Discuss on the Pie diagram for representing hydrogeochemical data. 10

9. *(a)* Enumerate the criteria considered for suitability of groundwater for irrigation purposes. Comment briefly on each of them giving emphasis on their working formula and suitability range. 15

(b) Discuss in brief on the use of Piper's trilinear diagram for determining the groundwater quality. 15

(c) Explain the role of radio isotopes in hydrogeological studies. 10

★ ★ ★